Final Report

WATER CONSERVATION STUDY

FT. DRUM, NEW YORK
WATERTOWN, NEW YORK

Prepared for

U.S. Army Engineer District, Norfolk
803 Front Street
Norfolk, VA 23510-1096

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LIST OF ABBREVIATIONS

AC	-	asbestos cement
AWWA	-	American Water Works Association
COE	-	Corps of Engineers
CY	-	cubic yards
DANC	-	Development Authority of the North Country
ECIP	-	Energy Conservation Investment Program
ECO	-	Energy Conservation Opportunity
EMC	-	E M C Engineers, Inc.
F	-	Fahrenheit
FEMP	-	Federal Energy Management Program
ft	-	foot, feet
gal	-	gallons
gpd	-	gallons per day
gpm	-	gallons per minute
hp	-	horsepower
hr	-	hour
HVAC	-	heating, ventilating, and air-conditioning
hz	-	hertz
in	-	inch
kgal	-	kilo-gallon, one thousand gallons
kW	-	kilowatt, one thousand watts
kWh	-	kilowatt-hours, one thousand watt-hours
LCCA	-	Life Cycle Cost Analysis
LF	-	linear foot (feet), load fraction
MES	-	M.E. Simpson Co., Inc.
mgd	-	million gallons per day
mi	-	mile(s)
O&M	-	operation and maintenance manual
ppm	-	parts per million
PVC	-	polyvinyl chloride
RTU	-	remote terminal unit
SIOH	-	supervision, inspection and overhead
SIR	-	Savings-to-Investment Ratio
SOW	-	scope of work
SPB	-	simple payback
UPS	-	uninterruptible power system
UPW	-	Uniform Present Worth factor
yr	-	year(s)

EXECUTIVE SUMMARY

AUTHORIZATION FOR STUDY

This study was conducted and this report prepared under Contract No. DACA01-94-D-0033, Delivery Order No. 0012. The contract was issued by the U.S. Army Engineer District, Mobile, Alabama, to E M C Engineers, Inc. (EMC) on 15 August 1994. The Norfolk District of the Corps of Engineers (COE) has responsibility for this study.

PURPOSE OF STUDY

The purpose of this water conservation study is to conduct a limited site survey and evaluate energy use and savings, estimate construction costs and water savings and provide a cost-to-savings ratio associated with repairing the leaks in the domestic water distribution system at Ft. Drum, New York.

METHOD OF ANALYSIS

Specific work required includes:

1. Perform a limited site survey of the domestic water system to collect data required to identify and evaluate specific energy conservation opportunities (ECOs).

2. Conduct a thorough survey of the potable water system using state-of-the-art underground leak detection equipment on all piping designated by Ft. Drum personnel.

3. Evaluate specific ECOs to determine energy savings potential and economic feasibility.

4. Provide programming documentation for recommended ECOs.

5. Prepare a report to document work performed, and to describe the results and recommendations of the site energy audit and the leak detection study.

LEAK DETECTION SURVEY

A leak detection survey was performed on all water distribution piping designated by Ft. Drum personnel. The leak detection analysis was performed using a combination of listening devices and preamplified-transducer systems to identify the majority of leak

locations. When the location of the leak could not be readily identified using these methods, a leak correlator was used. The leak correlator determines leak location based on the time it takes for sound to travel from the leak to a waterline connection point.

Eighteen leaks were identified by the survey on the water mains within the project scope area. The estimated leakage of 169,000 gallons per day (gpd) was categorized into the following types of leaks:

- One main line leak at 125,000 gpd.
- Two service line leaks at 29,000 gpd.
- One valve leaks at 2,000 gpd.
- Thirteen fire hydrant leaks at 13,000 gpd.

An additional 18,000 gpd of leakage was identified by the leak detection survey in 13 fire hydrants and one additional valve. However, the leak detection crew was able to tighten these appurtenances and eliminate the leaks.

ENERGY CONSERVATION OPPORTUNITIES

Approximately 8.7% of the water usage in the Ft. Drum water distribution system can be attributed to leakage. ECOs were evaluated that would serve to reduce leakage, thereby reducing water production, maintenance, and energy costs.

Description of ECOs

The following ECOs were evaluated for the water distribution system at Ft. Drum:

- **ECO 1.** Repair the main line and service line water leaks identified in the leak detection survey. One main line leak was located near Building T-2473 on a 12" line. Two service leaks were also identified. All three leaks should be repaired.

- **ECO 2.** Repair the water valve leak identified in the leak detection survey. One leaking water stub valve was identified and should be replaced.

- **ECO 3.** Repair fire hydrants which were found to be leaking during the leak detection survey. Thirteen fire hydrants were found to be leaking and should be replaced.

- **ECO 4.** Repair the main line, valve and fire hydrant leaks. This ECO is a combination of ECOs 1 through 3.

- **ECO 5.** Implement an annual water audit and leak detection program.

- **ECO 6.** Connect valve pit actuators to telemetry system to improve circulation. Connection of these valve actuators will allow system operators to automatically open and close valves, providing a low cost solution to stagnation problems in the western end of the old Post.

- **ECO 7.** Reconnect isolated main line near Oswego Avenue. Approximately 1,200 LF of 12" main line is currently isolated from the system. Reconnection of this segment of piping may serve to improve stagnation problems in the eastern end of old Post.

- **ECO 8.** Implement policy to optimize the percentage of water produced by Ft. Drum and by the DANC. Optimal quantities of water will be based on cost, water quality, reliability, and O&M requirements.

Economic Analysis

The economic analysis of the ECOs is summarized in Table ES-1 below.

Table ES-1. Summary of ECOs

ECO No.	Description	Investment Cost ($)	Annual Water Savings*	Total Discounted Savings ($)	SIR	Payback (yrs)	First Year $ Savings
1	Repair Main Line Leaks	2,612	56,210	623,681	238.82	0.06	46,261
2	Repair Valve Leaks	927	730	8,100	8.74	1.54	601
3	Repair Fire Hydrant Leaks	35,908	4,745	52,648	1.47	9.20	3,905
4	Repair All Leaks	39,447	61,685	684,430	17.35	0.78	50,767
5	Implement Leak Detection	29,120	62,621	302,564	10.39	1.30	22,417
6	Connect Valve Pit Actuators	3,247	396	4,394	1.35	9.96	326
7	Reconnect Isolated Main	11,333	132	1,465	0.13	104.32	—
8	Optimize Ft. Drum vs. DANC	-	-	-	-	-	—

*Annual Water Savings are in units of thousands of gallons saved per year

$\sum_{1}^{6}$ 186,387

124,277

All ECOs, except for ECO 7, display favorable economic payback. That is, they all have SIRs greater than 1.25 and a simple payback of 10 years or less. Based on the qualifications listed by the Scope of Work, these ECOs qualify for government energy conservation funding programs.

RECOMMENDATIONS

The ECOs listed in Table ES-2 are recommended for implementation.

Table ES-2. Recommended ECOs

ECO No.	Description	Investment Cost ($)	Annual Water Savings*	Total Discounted Savings ($)	SIR	Payback (yrs)
4	Repair All Leaks	39,447	61,685	684,430	17.35	0.78
5	Implement Leak Detection	29,120	62,621	302,564	10.39	1.30
6	Connect Valve Pit Actuators	3,247	396	4,394	1.35	9.96
8	Optimize Ft. Drum vs. DANC	-	-	-	-	-

*Annual Water Savings are in units of thousands of gallons saved per year

- **ECO 4.** Replace the main line, valves, and fire hydrants identified as having leaks by the leak detection survey. ECO 4 is a combination of ECOs 1 through 3. Although each of those ECOs are economically feasible based upon their own merits, combining them would simplify the programming documentation and produce a better project.

  Note that some of the leaks may have been repaired by maintenance personnel at the time they were discovered by the leak detection survey. Coordination with maintenance personnel will be required to determine which leaks are still in need of repair.

- **ECO 5.** Implement a leak detection program, including a water audit, every year as recommended by the American Water Works Association (AWWA) Manual 36, *Water Audits and Leak Detection.* Implement a policy to immediately excavate and repair all leaks discovered by the leak detection survey.

- **ECO 6.** Connect the water valve actuators in Valve Pit #4 to the telemetry system. Providing automatic control to the valves will allow flow to be alternated between the 16" and 20" main lines that join the old and new Posts. Increased flow through Valve Vault #4 (16" line) should improve water circulation on the western side of the old Post.

- **ECO 8.** Water consumed at Ft. Drum comes from two sources. Water provided by the DANC makes up approximately 75% of the total, while wells at Ft. Drum supply the remaining 25%. Ft. Drum currently pays $0.82 per thousand gallons of water, which accounts for water produced from the wells at Ft. Drum and also the variable costs of water produced by the DANC. Under an agreement, DANC provides a minimum of 1.5 mgd at a fixed cost according to a schedule provided by Ft. Drum personnel. (The cost in 1995 was $6.25/kgal. In 1997, after capital costs are paid in full, the cost is estimated to be $1.49/kgal.)

  The total cost of water from both sources was based on a combination of electrical costs, O&M costs, chemical treatment costs, and water storage costs. Calculations show that the total cost of the water produced by both sources decreases as more

well water is produced and less DANC water is used. The cost of water if Ft. Drum supplies 75% of the total water consumed was calculated to be $0.41 per kgal. The cost of water if Ft. Drum supplies 95% of the total was calculated to be about $0.24 per kgal.

It is reasonable to maintain an equitable balance between Ft. Drum well water and water supplied by the DANC. If Ft. Drum is able to negotiate a lower guaranteed water production rate from the DANC, it would produce lower annual costs.

In accordance with the SOW, Ft. Drum personnel provided direction regarding the combination of ECOs into projects. They requested that all appropriate ECOs be combined into one project. To be considered appropriate, the synergistic effects of the bundled ECOs must meet government funding criteria with an SIR of 1.25 and a simple payback of 10 years or less. Programming documentation has been prepared for ECOs 4, 5, 6, and 7. The results of the economic analysis for the bundled project are listed in Table ES-3 below.

Table ES-3. Economic Analysis for Bundled Project

Total Investment	$83,148
Annual Water Savings (kgal/year)	124,834
Annual Cost Savings	$73,618
Total Discounted Cost Savings	$992,857
Simple Payback (years)	1.13
Savings-to-Investment Ratio	11.94